WEST

Generate Collection

Search Results - Record(s) 1 through 1 of 1 returned.

☐ 1. Document ID: US 4858120 A

L1: Entry 1 of 1 File: USPT Aug 15, 1989

US-PAT-NO: 4858120
DOCUMENT-IDENTIFIER: US 4858120 A

TITLE: System for regulating arrivals of customers to servers

DATE-ISSUED: August 15, 1989

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Samuelson; Douglas A.	Reston	VA		

US-CL-CURRENT: 705/11; 379/112.01, 379/112.06, 379/309, 379/904, 705/32

CLAIMS:

I claim:
1. A method for controlling arrivals of customers to servers wherein customers are queued to await service by said servers, comprising the steps of:
measuring durations of customer service;
computing and updating time statistics of services to customers, thereby estimating expected duration of customer service;
recording starting time of each current customer service and noting present time;
comparing present time to starting time, and thereby determining time in progress for each customer service;
comparing time in progress to expected duration of service, and estimating time remaining in service for each customer currently in service;
determining a number of currently busy servers expected to be available by the time another customer arrival could reach the currently busy servers;
measuring the number of available servers not currently serving a customer;
adding the number of currently available servers and the number of currently busy servers expected to be available, thereby computing total number of servers expected to be available;
subtracting the number of customer arrivals currently queued awaiting service thereby producing a resultant number of servers expected to be available; and
controlling a processor which regulates customer arrivals to correspond to the resultant number of servers expected to be available.
2. The method of claim 1, further comprising the steps of:
measuring a ratio of number of service initiations to numbers of customer arrivals;
calculating the number of service initiations by dividing the total number of servers expected to be available by said ratio during a selected time interval of recent operation.
3. The method of claim 2, wherein the step of calculating comprises the steps of:
computing a weighted average of the total number of servers expected to be available; and
calculating with that weighted average the number of arrivals being initiated by the processor which regulates customer arrivals.
4. The method of claim 1, wherein the step of computing and updating time statistics comprises the steps of:
classifying service times as short or long;
measuring mean, minimum, and maximum of short service times; and
measuring mean, minimum, and maximum of long service times.

5. The method of claim 4, wherein the comparing of time in progress to the expected duration of service comprises comparing the time in progress to a measured minimum time of service during a selected recent time interval of operation.

6. The method of claim 4, wherein the comparing of time in progress to the expected duration of service comprises comparing the time in progress to a measured maximum time of service during a selected recent time interval of operation.

7. The method of claim 4 wherein the comparing of time in progress to the expected duration of service comprises comparing the time in progress to a measured mean (average) of times of service during a selected recent time interval of operation.

8. The method of claim 4 wherein the step of comparing time in progress to expected duration of service comprises the steps of:
computing an estimated boundary between long and short services;
classifying services which have been in progress longer than said estimated boundary as long services, and classifying other services in progress as short services; and
using the estimated duration of long services as the expected duration of service for services currently in progress which are classified as long services, and
using the estimated duration of short services as the expected duration of service for services currently in progress which are classified as short services.

9. The method of claim 8 wherein the step of computing an estimated boundary further comprises calculating a weighted average of the means of the short and long service times and using the weighted average as the estimated boundary between long and short service times.

10. The method of claim 8 wherein the step of computing the estimated boundary further comprises calculating a weighted average of the maximum duration of short services and the minimum duration of long services and using said weighted average as the estimated boundary between long and short services.

11. The method of claim 8 wherein the step of computing the estimated boundary further comprises using the mean duration of short services plus s standard deviations of the durations of short services as the estimated boundary between long and short service times, where s is any positive number.

12. The method of claim 8 wherein the step of computing the estimated boundary further comprises using the mean duration of long services minus t standard deviations of the durations of long services as the estimated boundary between long and short service times, where t is any positive number.

13. The method of claim 4 wherein the step of classifying comprises the steps of:
using the measured mean of the short service times as an estimated duration of short services; and
using the measured mean of the long service times as an estimated duration of long services.

14. The method of claim 4 wherein the step of classifying comprises using the minimum duration of short services as the estimated duration of short services.

15. The method of claim 4 wherein the step of classifying comprises using the maximum duration of short services as the estimated duration of short services.

16. The method of claim 1, wherein customers may return to servers for subsequent stages of service, further comprising counting the number of customers having completed service but available (still within the system) to return to a subsequent stage of service, and subtracting the number of customers having completed service but expected to return to a subsequent stage of service from the total number of servers expected to be available, to regulate arrivals so as to ensure availability of servers for customers returning to service.

17. The method of claim 16, further comprising computing the estimated proportion of customers having completed one stage of service who are expected to return for subsequent service, and subtracting said estimated proportion, rather than the total number of customers having completed service and available to return to a subsequent stage of service, from the total number of servers expected to be available, to regulate arrivals.

18. The method of claim 1, further adjusting automatically to provide a specified proportion, q, of arrivals for which no server is available, comprising the steps of:
computing a quantile such that the proportion qn of service times less than said quantile is equal to the pre-selected proportion q; and
using the said quantile as the estimate of duration of service.

19. The method of claim 18, further iteratively adjusting expected duration of service, d, to maintain a pre-selected proportion q of arrivals for which no server is available, comprising the steps of:

using a statistic of service times as an initial estimate, d=d.sub.1, of the duration of service;
decreasing d to d.sub.2 =0.9d.sub.1 if the resulting proportion q.sub.1 of arrivals for which no server is available is higher than q;
increasing d to d.sub.2 =1.1d.sub.1 if the resulting proportion of arrivals q.sub.1 for which no server is available is lower than q, and
computing d.sub.n p.sub.1 =d.sub.n +(q-q.sub.n)(d.sub.n -d.sub.n m.sub.1)/(q.sub.n -q.sub.n m.sub.1) at each step where d.sub.n p.sub.1 is the new calculated d, d.sub.n is the most recently used estimate of d, d.sub.n m.sub.1 is the next most recently used estimate of d, q.sub.n is the proportion of arrivals for which no server was available when d.sub.n was used as the estimate of d, and q.sub.n m.sub.1 is the proportion of arrivals for which no server was available when d.sub.n m.sub.1 was used as the estimate of d.

20. The method of claim 1 wherein the step of determining a number of currently busy servers expected to be available comprises the steps of:
measuring times from the point of initiating arrivals to start of service and thereby estimating expected transit times; and
comparing said transit times to estimated time remaining in service for the currently busy servers.

Full | Title CIT.1 REV.1 CLS.1 REF.1 DRAW.1

Generate Collection

Terms	Documents
4858120.pn.	1

Display 100 Documents, starting with Document: 1

Display Format: CLM Change Format

8 **Allocating resources or scheduling for an administrative function:**
This subclass is indented under subclass 7. Subject matter for the distribution of resources or for scheduling in a business or commercial environment.

SEE OR SEARCH THIS CLASS, SUBCLASS:

2, for prediction of medical facility usage.

SEE OR SEARCH CLASS:

368, Horology: Time Measuring Systems or Devices, for a timing arrangement of general utility.

700, Data Processing: Generic Control Systems or Specific Applications, subclasses 95 through 212for this subject matter combined with a step of, or structure for product manufacture or parts assembly or allocation.

708, Electrical Computers: Arithmetic Processing and Calculating, 112 for this subject matter with calendaring.

OTHER CLASSIFICATION SYSTEMS:

Type:	Group:	Description:
ECLA G06F	17/60A4	for time management, e.g., calendars, reminders, meeting scheduling.
ECLA G06F	17/60C2	for resource allocation, e.g., PERT.

9 **Staff scheduling or task assignment:**
This subclass is indented under subclass 8. Subject matter for scheduling of or assigning a tasks to an individual or group.

1. Note. The designation of an individual may be either by name or other designation, e.g., position.

SEE OR SEARCH CLASS:

708, Electrical Computers: Arithmetic Processing and Calculating, subclass 112 for a digital calculating computer with a calendar designation.

6 **Coordination of plural reservations (e.g. plural trip segments, transportation and accommodation, etc.):**
This subclass is indented under subclass 5. Subject matter wherein the processing system coordinates multiple distinct reservations for a single itinerary.

1. Note. The term "multiple distinct reservations" is not intended to include a plurality of similar reservations (e.g., reservations for a plurality of seats).

OTHER CLASSIFICATION SYSTEMS:

Type:	Group:	Description:
ECLA G06F	17/60C8D	[for organizing, forecasting, or planning] of routes, e.g., traveling salesman.

7 **Operations research:**
This subclass is indented under subclass 1. Subject matter drawn to a computerized arrangement for the systematic and scientific analysis and evaluation of a the operation of an organization or the programmed scheduling of an organization.

SEE OR SEARCH THIS CLASS, SUBCLASS:

32, for time accounting of employees or customers, i.e., the tabulation of attendance or timed presence of employees or patrons.

SEE OR SEARCH CLASS:

235, Registers, subclass 376 for record-sensing devices in combination with systems utilized for operations analysis.

OTHER CLASSIFICATION SYSTEMS:

Type:	Group:	Description:
ECLA G06F	17/60C	for organizing, forecasting, or planning
ECLA G606F	17/60C8	for optimization.
ECLA G06F	15/46	for optimization during production.
DERWENT	T01-J05A2	for administration and management tools including management, resource allocation, business, education, government, marketing and law; also includes decision support, MIS, stock control, and workflow.